

Abstract of the Disclosure

Pumping requirements for chromatograph applications are for constant flow at high and variable pressures and for accurate programmable control of liquid composition. A two-cylinder pump, pumping system, and associated controls provide an accurate, fixed flow rate. A low pressure gradient former controls composition. During the initial portion of the pumping stroke of a first piston in which fluid is being compressed due to its finite bulk modulus of elasticity its check valve remains closed, a second piston provides all the flow required at a fixed rotational speed. Then, once the first piston has reached its bottom dead center, the control system switches to a constant-pressure control mode, thereby maintaining the flow rate at a fixed value. Constant-pressure control is again switched off either when the second piston's discharge check valve closes, or when the second piston's inlet check valve opens, and pump control returns to fixed rotational speed. Determining the angular displacement at which to effect these control-mode switches is carried out by monitoring the discharge pressure and storing the values of the angular displacement at which the first temporal derivative of pressure changes rapidly. The invention provides novel arrangement for synchronizing the gradient generator by equating recompression volume to recompression volume of the high pressure pump.